

Date of Report: August 15, 2000

EPA Agreement Number: R82806001-0

Title: PM_{2.5} Technology Assessment and Characterization Study in New York State (PMTACS-NY)

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Institution: Atmospheric Sciences Research Center, University at Albany

Research Category: Particulate Matter EPA "Supersites" Program

Sorting Code: 99-NCERQA-X1

Project Period: April - June 2000

Objective of Research:

As a result of recent clinical and epidemiological studies (NRC, 1998) associating adverse health effects in humans and fine particle mass, a new National Ambient Air Quality Standard for PM_{2.5} mass (15 $\mu\text{g}/\text{m}^3$ annual and 65 $\mu\text{g}/\text{m}^3$ 24-hr average) has been promulgated in the United States (Federal Register, 1997). Significant scientific and technical issues surrounding the mitigation of the warm season PM_{2.5} /co-pollutant complex and its interdependence with O₃ air quality through coupled photochemical pathways, common precursors, and similar dependencies upon meteorology must be addressed if effective control strategies are to be implemented.

The long-term monitoring of the PM_{2.5}/co-pollutant complex and its precursors at urban and regional representative sites provides the opportunity to track the impact of emission controls and their effectiveness on air quality. These data can be used to verify that implemented PM_{2.5} primary and secondary precursor (including ozone precursor) emission controls are performing according to specifications and verify that PM_{2.5} and ozone air quality has responded to the emission changes achieved as expected. Without adequate monitoring systems to track the progress and effectiveness of implemented control programs, the air quality management approach remains unaccountable.

The PMTACS-NY Supersite program provides a unique and unparalleled opportunity to enhance our understanding of ozone/PM_{2.5}-precursor relationships and track progress in current precursor emission control programs and assess their effectiveness in achieving expected air quality responses. The impact of this research is highly significant, providing a sound scientific basis for informed effective decisions in the management of air quality in New York and will benefit its citizens both environmentally and economically.

The PMTACS-NY is designed around three major objectives and addresses a series of science policy relevant questions related to hypotheses to be tested using measurement

data collected under the program. The subject quarterly reports provide highlights on the overall program status, the progress made in the context of the specific tasks associated with the three program objectives, identification of outstanding issues, project schedule and completion status by task, and a budget analysis.

Progress Summary/Accomplishments:

Administrative and scientific meetings continued during this quarter, addressing coordination issues amongst Supersite PIs, briefing the various stakeholder communities and identifying collaborative efforts between EPA participants and Supersite project scientists. We participated in the Eastern States - Supersite PI's Coordination Meeting, April 12-13, 2000, in Baltimore, MD and our science team has helped organize and has participated in several newly established Supersite Working Groups (Data Management – T. Coleman, Quality Assurance – V. Mohnen, and Aerosol Sizing Instrumentation – G. Lala) with EPA collaborators. These working groups will address specific generic scientific issues facing all the Supersite programs. The draft PMTACS-NY QAPP was completed on June 15 and submitted to Dennis Mikel, EPA Quality Assurance Manager, for review and comment. Administrative activities included: 1) negotiation and signing of the sub award (contract) between University of Albany and Aerodyne Research, Inc.; 2) continuation of negotiations regarding the access of NYS Environmental Bond Act funds (part of the equipment cost share identified in PMTACS-NY); and 3) review of the scope of work and initiating the paperwork for the sub award with NYS Department of Health.

Objective I. Measure the temporal and spatial distribution of the PM_{2.5}/co-Pollutant complex including: SO₂, CO, VOCs/Air Toxics, NO, NO₂, O₃, NO_y, H₂CO, HNO₃, HONO, PM_{2.5} (mass, SO₄²⁻, NO₃⁻, OC, EC, Trace Elements), single particle aerosol composition, CN, OH and HO₂ to support regulatory requirements to develop cost effective mitigation strategies PM_{2.5} and its co-pollutants and to establish trends in the relevant precursor concentrations to assess the impact of recent and future emission reductions in terms of emission control effectiveness and air quality response.

We have been actively visiting and reviewing other potential sites in the boroughs of Manhattan and Queens in collaboration with the NYSDEC. Several alternative sites have been identified and preliminary negotiations between NYSDEC and the institution's facilities managers have begun. Given historical precedent of such negotiations and the time to perform necessary space renovations, it is unlikely that these sites will be available by July 15. Since a major element of our program is to augment and demonstrate advanced measurement technologies at NYSDEC monitoring sites, we are currently reviewing our options with NYSDEC and the implications to our programs. Instrumentation upgrades to the South Bronx monitoring site are underway.

NYS has committed to deploying R&P M2300 sequential filter samplers for its chemical speciation network. These samplers will also be used at the PMTACS-NY sites with one or more speciation samplers operating under other programs.

Objective II. Monitor the effectiveness of new emission control technologies [i.e. Compressed Natural Gas (CNG) bus deployment and Continuously Regenerating Technology (CRT)] introduced in New York City and its impact on ambient air quality, thorough remote open path roadside, mobile platform, and fixed site measurements of CO₂, CO, NO, H₂CO, HONO, CN and aerosol chemical composition.

On May 5 we meet with Aerodyne Research, Inc to discuss deployment and scheduling issues associated with the mobile measurement platform. This was followed by a meeting on May 16 with the MTA at the Brooklyn Depot in NYC to brief them on the program and to solicit their participation in the CEPEX project. This initial meeting involved PMTACS collaborators from NYSDEC emissions division (R. Gibbs and T. Lanni), P. Galvin, NYSDEC monitoring division and K. Demerjian, project PI and from MTA NYC Transit R&D (B. Parsley, D. Lowell, and C. Bush). The meeting was a success and we will have MTA cooperation in performing the CEPEX prototype studies. We have scheduled a meeting with MTA personnel in early September to bring together the science team involved in the prototype demonstration studies to discuss logistical, operational and programmatic issues. The experiments will be performed within the October 1 - November 15 timeframe.

Objective III. Test and evaluate new measurement technologies and provide tech-transfer of demonstrated operationally robust technologies for network operation in support of the development of process science and observation based analysis tools and health based exposure assessments.

Performance evaluation studies of a modified TEOM mass monitor have been underway for most of this quarter, in conjunction with another ASRC - R&P research and evaluation study. The aerosol generation and calibration laboratory is being used to perform side-by-side evaluation experiments of TEOM mass monitors (Rupprecht & Patashnick Model 1400) to assess the effects of temperature and relative humidity on this mass monitor. Two TEOM systems are operated simultaneously, the first a standard TEOM configuration (air stream heated to 50°C, filter and sensor operating at 50°C) and the second, a TEOM equipped with a Nafion dryer (air stream heated to 30°C, filter and sensor operating at 30°C). The experiments involve sampling aerosols of known composition and size at various relative humidity levels to determine 1) the dryer's effectiveness in water management and its implications on ambient PM mass measurements and 2) the effect of the TEOM's operational temperature on the evaporative loss of PM mass.

Publications/Presentations: PMTACS-NY program overview presentation at Eastern States – Supersites Coordination Meeting, April 12-13, 2000, Baltimore, MD and briefing at NYC MTA May 5, 2000, Brooklyn, NY regarding CEPEX demonstration study.

Future Activities and Outstanding Issues:

We hope to have our draft PMTACS-NY QAPP finalized and accepted in the coming quarter. Planning for the CEPEX study continue with a major meeting schedule at MTA this coming quarter to finalize field deployment. Although we have yet to receive the NYSDEC Environmental Bond Act Funds, a major component of the equipment cost share for this project, recent progress looks very promising. We expect to have the funds in place by next quarter and have contacted vendors associated with long lead-time (6-9 months) equipment (e.g. TILDAS and AMS) purchases to anticipate our orders. We now believe that we will be able to meet scheduling requirements for the 2001 summer intensive studies. NYC monitoring site renovation and construction issues regarding Mable Dean Bacon remain uncertain. The Queensborough Community College (PAMS) monitoring site will likely move to the campus of Queens College upon completion of this year's PAMS monitoring season. Our current plan is to use this as our alternate site for PMTACS-NY program in place of Queensborough Community College that had been originally identified in the proposal. Resolution of this matter is anticipated by the next quarter.

Supplemental Keywords: ambient air, atmospheric aerosols, ozone, particulate matter, metals, nitrogen oxides, sulfates, organics, atmospheric chemistry, monitoring, measurement methods, northeast air quality.

Relevant Web Sites:

ID	Task Name	Start	2000				2001				2002				2003				2004			
			Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4
1	TASK 1 Planning and Coordination Meetings	Tue 2/8/00																				
2	✓ EPA - Supersite PI's Kick Off Meeting RTP, NC	Wed 3/22/00																				
3	✓ Eastern States - Supersites Coordination Meeting	Wed 4/12/00																				
4	↻ Supersite EPA Liason and Science Advisory Meetings	Wed 2/7/01																				
9	↻ Supersite Work Group Participation and EPA Collaboration	Tue 2/8/00																				
29	Meetings with Aerodyne and MTA - Coordination of CEPEX Study	Tue 4/4/00																				
30	TASK 2 Preparation of Quality Assurance Project Plan (QAPP)	Mon 2/7/00																				
31	QA Project and SS Meetings	Mon 2/7/00																				
32	Compilation and Development of SOPs	Mon 2/7/00																				
33	✓ Draft QAPP submitted for EPA Review and Comment	Mon 2/7/00																				
34	Revisions and Final EPA Approved QAPP	Mon 7/3/00																				
35	TASK 3 Major Equipment Purchases and Instrument Fabrication	Mon 2/7/00																				
36	Secure NYS Bond Act Funds for PM Analytical Facilities	Mon 2/7/00																				
37	✓ Order R&P Continuous PM Carbon Instrument and PM Nitrate	Mon 5/8/00																				
38	Build NO2 (Photolytic Titration) measurement Systems	Wed 3/15/00																				
39	✓ Review status and order Sequential Chemical Speciation Samplers	Wed 3/1/00																				
40	Site Renovations and Power Upgrades at Selected Sites as Needed	Mon 2/7/00																				
41	Site installation of new instrumentation technologies	Wed 3/15/00																				
42	TASK 4 Network Operations	Mon 2/7/00																				
43	Deploy and Operate EPA Designated Criteria Pollutant Measurements	Mon 2/7/00																				
44	Deploy and Operate Filter Based Chemical Speciation Measurements	Thu 8/17/00																				
45	Deploy and Operate New Continuous PM Chemical Speciation Measurement Instrumentation	Tue 7/18/00																				
46	Deploy and Operate New Continuous PM Mass Measurement Instrumentation	Mon 7/24/00																				
47	TASK 5 CEPEX Field Studies	Wed 3/15/00																				
48	CEPEX Planning Site Selection and Deployment Routes	Wed 3/15/00																				
49	CEPEX Mobile Laboratory Deployment - Proof of Concept Study	Mon 9/25/00																				
50	Demonstration of In Situ Emissions Measurement Technologies	Thu 12/28/00																				
51	CEPEX 2001 Summer Field Intensive	Mon 7/2/01																				

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			Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4
52	TASK 6 Special Studies - 2001 Summer Field Campaign	Mon 7/2/01																				
53	Deployment and Operation of OH/HO2 Instrumentation - PSU	Mon 7/2/01																				
54	Deployment, Operation and Intercomparison of Single Particle Aerosol - Mass Spectrometers	Mon 7/2/01																				
55	Deployment and Operation of a Continuous HONO/HONO2 Measurement System	Mon 7/2/01																				
56	Deployment and Operation of Aerosol Particle Sizing Instrumentation	Mon 7/2/01																				
57	TASK 7 Special Studies - 2003 Winter Field Campaign	Mon 2/17/03																				
58	Deployment and Operation of OH/HO2 Instrumentation - PSU	Mon 2/17/03																				
59	Deployment, Operation and Intercomparison of Single Particle Aerosol - Mass Spectrometers	Mon 2/17/03																				
60	Deployment and Operation of a Continuous HONO/HONO2 Measurement System	Mon 2/17/03																				
61	Deployment and Operation of Aerosol Particle Sizing Instrumentation	Mon 2/17/03																				
62	TASK 8 Data Quality Assessment and Management	Mon 2/14/00																				
63	Participation in Data Management Working Group	Mon 2/14/00																				
92	Development and implementation of data mangement protocols and standards	Mon 3/6/00																				
93	Compilation, Archive and Distribution of Measurement Data Sets	Mon 2/12/01																				
102	QA Experiments and Intercomparison Studies	Mon 9/11/00																				
109	TASK 9 Aerosol Generation, Calibration and Instrument Evaluation	Tue 2/15/00																				
110	Generation of size selected pure inorganic and organic aerosol calibrants	Tue 2/15/00																				
111	Generation of size selected pure inorganic and organic aerosol calibrants in 10-95% RH	Tue 2/15/00																				
112	Laboratory evaluation of Nafion dryer retrofitted R&P TEOM PM2.5 mass monitors	Wed 5/17/00																				
113	Laboratory evaluation of R&P continuous PM2.5 carbon and nitrate analyzers	Fri 11/3/00																				
114	Laboratory evaluation of R&P differential dual ESP TEOM PM2.5 mass monitor	Mon 10/15/01																				
115	Laboratory evaluation of Aerodyne Aerosol Mass Spectrometer	Mon 2/12/01																				
116	TASK 10 Data Analysis and Hypothesis Testing	Mon 9/18/00																				
117	Trends in historical and PMTACS measurements of PM mass and SO4= and NO3- species provide d	Mon 12/4/00																				
118	PM10/PM2.5 sulfate and nitrate production efficiencies are directly proportional with ozone production	Tue 9/4/01																				
119	PM Fe/Mg ratios provide an effective signature of oil derived combustion aerosol.	Mon 2/4/02																				
120	PM V/Se ratios provide an effective signature of coal vs. oil derived aerosol on the regional scale.	Mon 2/4/02																				
121	PM As/Se ratios provide an effective signature of mid-western vs. Canadian derived aerosols	Tue 1/30/01																				

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			Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4
122	Enhanced PM composition and gas phase measurements provide an effective means for distinguishir	Mon 10/8/01																				
123	NYC summertime SO4 is dominated by local SO2 gas to particle transformation	Tue 7/3/01																				
124	Regional SO4 in New York State is dominated by long range transport of transformed SO2 emissions	Thu 2/1/01																				
125	Biogenic hydrocarbons represent a significant source of the semi-volatile organic matter mass fractior	Mon 9/18/00																				
126	Changes in ambient PM sulfate mass fraction are anti-correlated with changes in the ambient PM nitr	Thu 10/19/00																				
127	CNG-fueled buses in New York City show measurable reductions of vehicle NO, SO2 and PM emissic	Thu 12/28/00																				
128	CRT control technology with low sulfur fuels in retrofitted diesel buses in New York City shown measu	Thu 2/22/01																				
129	The deployment of CNG-fueled and CRT-retrofitted diesel fleets show measurable reductions in ambi	Fri 4/20/01																				
130	The EPA designated filter based reference method underestimates the actual atmospheric PM2.5 ma	Tue 4/3/01																				
131	Water management and temperature control of existing continuous automated mass, total sulfur and	Thu 5/31/01																				
132	Measurements of the optical properties of the atmosphere (aerosol light scattering and absorption) us	Thu 12/12/02																				
133	Quantitative amounts of gaseous pollutants (e.g. PAH, H2CO, xylene, trichlorethylene, etc.) are absor	Tue 10/29/02																				
134	PM chemical composition varies by aerodynamic size, which in turn varies in time, and with temperatu	Tue 12/17/02																				
135	Heterogeneous processes contributed to the oxidizing capacity of the atmosphere resulting in signific	Mon 12/16/02																				
136	TASK 11 Reporting	Mon 2/7/00																				
137	Quarterly Letter Report	Mon 5/15/00																				
152	QAPP Report	Mon 2/7/00																				
153	QAPP V.1.0	Mon 2/7/00																				
154	QAPP Revisions as needed (QAPP V1.1,..., V.2.0,...etc)	Mon 7/17/00																				
155	Conference Presentations and Publications	Wed 2/7/01																				
156	AGU Fall Meeting	Wed 2/7/01																				
161	Preparation and Submission of Peer Review Publications	Wed 2/7/01																				

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